

An entry into the HOV facility should require a conscious movement. A design configuration, which requires mixed-flow traffic to exit, could be susceptible to violations.

Normally an HOV lane should begin on the left of the number one mixed-flow lane as a new lane, at a 90-degree angle (Details M-1 and M-2, Chapter 5) to full width. For a buffer-separated facility, a minimum of 400m of dashed white line should be offered on the right to provide consistency of appearance with ingress and egress areas. See Figure 4.2. The beginning of any buffer should begin no earlier than a distance equivalent to 200m per lane change required entering the HOV lane from the nearest on-ramp. Additional length of dashed white lines may be desired if visibility of the striping is compromised within the 400m distance; for example, at locations where vertical and horizontal curves are present.

See Appendices A-4 and A-5: Caltrans, Traffic Operations Memorandum, The Ending of High-Occupancy Vehicle (HOV) Lanes, December 11, 1995.

continuing lane which enables the HOV traffic to continue without a merge. When a lane end has to occur it shall become the standard to drop the outside mixed-flow lane as shown on the attached drawing (Detail M-6, Chapter 5).” If an exception is needed, document the reasons and request an approving signature from the appropriate Headquarters’ Traffic Liaison and Headquarters’ Design Coordinator. “Frequently, the ending of the HOV lane could be shifted up or downstream to make a right merge more feasible.”

“Revisions of plans are required for projects in the planning or design stage.” For those HOV projects under construction with the HOV lane merging, we request review of these projects and request contract change orders as needed.

If the HOV lane has to be merged back into the freeway traffic, a minimum of 400m of dashed white line (920m is desirable) should be provided before the end of the HOV lane taper begins. Additional length may be desired to achieve enhanced or improved visibility of dashed striping at location where horizontal or vertical alignment vary. No less than 200m per lane change should be provided from the end of the buffer to the next off-ramp or connector. See Figure 4.2. Where feasible, greater length may be desired.

In addition, the outside mixed-flow lane may also be dropped at an off-ramp. Engineering analysis is essential with this alternative to ensure congestion does not result near the lane drop location. Typically, there should be a high demand exiting the off-ramp where the lane drop is considered.

### Section 4.2 Ingress/Egress For Barrier-Separated Facilities

The at-grade ingress and egress from the mixed-flow lanes to a barrier-separated HOV facility can be achieved with at-grade channelized openings in the physical barriers. A typical geometric configuration is shown in Figure 4.1. The at-grade opening can be accomplished with the use of a weave lane to assist the merging of the HOV traffic with the mixed-flow traffic. The preferable length of the weaving area for ingress and egress designs is 400m, minimum.

Other means of providing access to and from barrier-separated facilities include, but are not limited to:

- A. Median drop ramps from overcrossings or undercrossings.
- B. Freeway-to-freeway connection.

### Section 4.3 Ingress/Egress For Buffer-Separated Facilities

Access to and from the HOV lane should be provided by any of the following four general types of ingress and egress designs:

- A. At-grade ingress and egress.
- B. Median drop ramps from overcrossings or undercrossings.
- C. Freeway-to-freeway connection.
- D. Beginning and termination points (as described above).

At-grade access is not intended to serve every on and off-ramp. When it is operationally possible, ingress and egress locations are based on the following criteria:

- 1. To serve every freeway-to-freeway connection.
- 2. To serve high volume ramps.
- 3. Ramps with high number of carpools.
- 4. When adjacent to park and ride facilities.

- 5. When requested by transit districts.
- 6. To assist in the modification of local commute patterns (may be at local request).
- 7. To help balance and optimize interchange operational level of service within a local jurisdiction, within a corridor, or within a region.
- 8. To support and encourage ride sharing programs (HOV demand/usage).

As applied to the buffer-separated facilities, ingress and egress are relative to the origin and destination patterns of HOVs. If the majority of HOVs originate upstream and have destinations downstream of the facility, they will all use the lane facility and there will be little impact related to intermediate access points. However, intermediate access points will allow fuller use of the facility.

The operation of weaving sections needs to be considered. It is important that ingress and egress locations be of proper length and located to provide the best possible access, especially to adjoining freeways. There could be situations in which merging to and from the HOV lane can create queueing in the HOV lane. One example would be providing ingress and egress near ramp locations on a freeway that has many closely spaced ramps in a bottleneck section. This could create conflicts in the flow of both the HOV and mainline facilities. Design should include the consideration of an additional lane between these ramps to allow ingress/ egress to the HOV facility without adversely impacting either it or the mixed-flow lanes. Figure 4.2 indicates recommended weaving distances for buffer-separated facilities.

Provisions for traffic to enter and leave the HOV facility should be provided at every freeway-to-freeway interchange. Ingress and egress to State highways and major arterials should be considered where demand exists and where operation is not severely impacted.

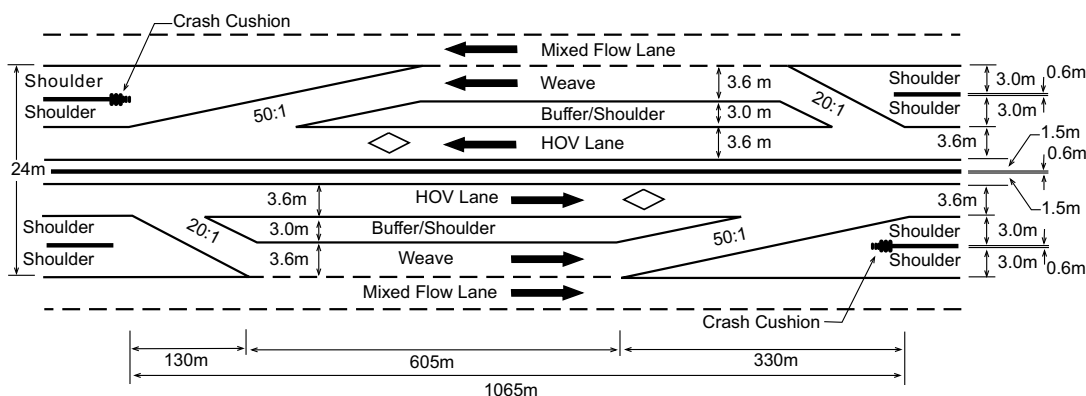
Ingress and egress locations should be on a tangent and away from CHP enforcement areas whenever possible. To ensure ingress and egress locations are placed at optimal locations, District Traffic Operations personnel and the Headquarters' Traffic Liaison should be consulted early in the design phase.

### **Section 4.4 Ingress and Egress For Contiguous HOV Facilities**

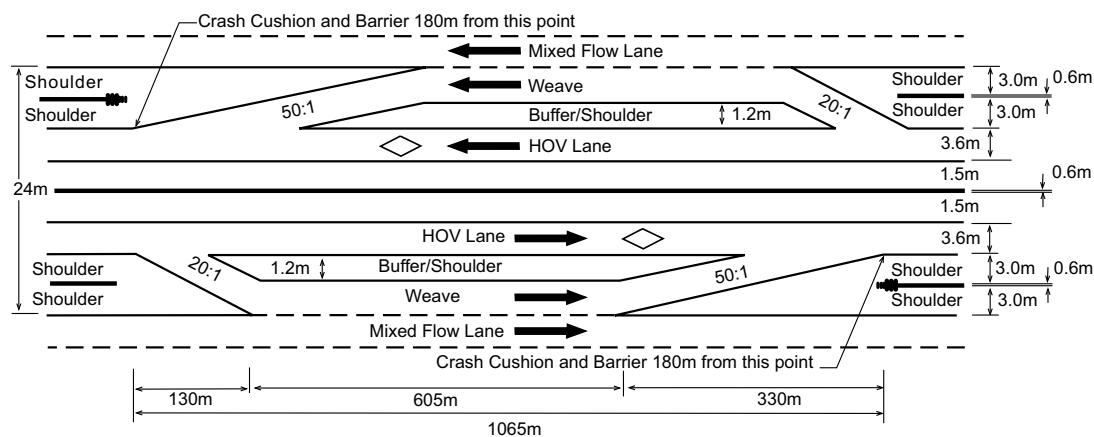
At-grade access for contiguous HOV facilities is unlimited since no buffer or barrier separates the HOV lane from the mixed-flow traffic. See Detail M-3, Chapter 5, as well as the Manual on Uniform Traffic Control Devices (MUTCD) and California Supplement to the MUTCD, which replaces Caltrans' Traffic Manual. When a lane has to be discontinued, it is preferable to drop the outside mixed-flow lane approximately 0.8km after the end of the HOV facility. See Detail M-6, Chapter 5 for more information.

**FIGURE 4.1  
INGRESS/EGRESS FOR  
BARRIER-SEPARATED HOV FACILITIES**

NOT TO SCALE



**FOR 3.0m BUFFER/SHOULDER AREA**



**FOR 1.2m BUFFER/SHOULDER AREA**

**NOTE:** When necessary, any deviation from the HDM mandatory standards must be discussed with the Headquarters' Design Coordinator and, if justified, will require approved design exception fact sheets. For the mixed-flow lanes, widths for the outside shoulder and the outside lane generally should not be altered. When sufficient justification exists, suggested priority for reduction of the cross-sectional elements for the various geometric configurations is outlined in Section 3.10. Any deviation from these recommendations should be discussed with the FHWA Transportation Engineer, Traffic Operations personnel, from the District and Headquarters, Traffic Operations Liaison and Design Coordinator.



The diagrams illustrate the layout of a multi-lane highway with HOV lanes, showing ingress/egress and HOV lane sections with various buffer and travel distances.

**Diagram 1 (Left):** Shows a multi-lane highway with an **ON-RAMP** on the left and an **OFF-RAMP** on the right. The main section is labeled **INGRESS/EGRESS**. It features four lanes: **ONLY**, **POOL**, **CAR**, and **ONLY**. Distances are marked as **INGRESS/EGRESS 400m** and **BEGIN BUFFER**. Buffer distances of **200m** are indicated between the ramp and the main section, and between the main section and the off-ramp.

**Diagram 2 (Middle):** Shows a multi-lane highway with an **ON-RAMP** on the left and an **OFF-RAMP** on the right. The main section is labeled **BEGIN HOV LANE**. It features four lanes: **ONLY**, **POOL**, **CAR**, and **ONLY**. Distances are marked as **INGRESS 400m** and **BEGIN BUFFER**. Buffer distances of **200m** are indicated between the ramp and the main section, and between the main section and the off-ramp.

**Diagram 3 (Right):** Shows a multi-lane highway with an **ON-RAMP** on the left and an **OFF-RAMP** on the right. The main section is labeled **END HOV LANE**. It features four lanes: **ONLY**, **POOL**, **CAR**, and **ONLY**. Distances are marked as **END BUFFER** and **200m** between the ramp and the main section, and between the main section and the off-ramp.

**NOTE:** Any deviation from mandatory standards shall be discussed with the FHWA Transportation Engineer (at, or impacting, interstate freeways), Traffic Operations personnel (from both the District and Headquarters), Headquarters' Traffic Liaisons and Headquarters' Design Coordinators.